Section 19 Sevier River Basin
GROUNDWATER

Tables

Figures

Section Nineteen Sevier River Basin - State Water Plan

Groundwater

Groundwater is an important component of the total water resources.

19.1 INTRODUCTION

This section describes the groundwater resources for the Sevier River main stem, Pahvant Valley, Round and Scipio Valleys, and the Levan-Mills area. The main stem groundwater is more critical because of the interrelationship of water flows from area to area. Groundwater data for Little Valley, Dog Valley and Tintic Wash Valley are negligible concerning storage, withdrawal and quality. There is some potential for development in these areas.

Groundwater is not visually discernable in place and as a result, is difficult to quantify. The determination of groundwater quality is more easily defined.

Groundwater is used primarily for irrigation. Other uses include public water supplies, domestic water and stock water. Springs have often been the first to be developed by the settlers for household and miscellaneous uses. It wasn't until about 1900 that wells were first used to supply irrigation water. In about 1915, artesian wells were drilled in Flowell, west of Fillmore and by 1920, they supplied about 10 percent of the irrigation water in that area.

All water quality data are presented first in milligrams per liter and second as it was reported in the original study report. See Appendix A, Acronyms, Abbreviations and Definitions for specific definitions of water quality units of measurements.

19.2 GROUNDWATER GEOLOGY AND RESERVOIR CHARACTERISTICS

The Sevier River main stem is characterized by a series of groundwater basins or reservoirs along the river system, each separated from the one upstream by a relatively impermeable, underground geologic restriction. These are shown, along with others around the basin, in Figure 19-l. A typical groundwater reservoir cross-section on the Sevier River is shown in Figure 19-2. The U.S. Geological Survey has estimated the groundwater reservoirs above Sevier Bridge Reservoir contain more than five million acre-feet of water in the upper 200 feet of alluvial fill. See Table 19-1 for data on the groundwater reservoirs. They are supplied by water from several sources; the river and irrigation canals as they traverse the valley, deep percolation from irrigation and precipitation, and groundwater tributary inflow.

The functions of the groundwater reservoirs above Sevier Bridge Reservoir are an integrated part of the operation of the Sevier River system. When a groundwater reservoir is full, it spills over the geologic restriction and contributes to the downstream flow of the river. The soil profile in the lower elevation land areas in each basin becomes saturated when the groundwater reservoir is full, enabling high water-using vegetation (phreatophytes) to grow.

Conversely, as the supply of water declines or when large volumes of water are pumped for an extended period of time, the wet areas are dried up with a subsequent decrease in consumptive use. When this happens, some of the water which normally drains to the river as return flow percolates downward to refill the groundwater reservoir, reducing the downstream river flow.

Return flows are important to the regimen of the Sevier River. Analysis has shown about 50 percent of the total tributary inflow and river diversions reappear as surface water for rediversion downstream. Much of the diverted water percolates down through the root zone and

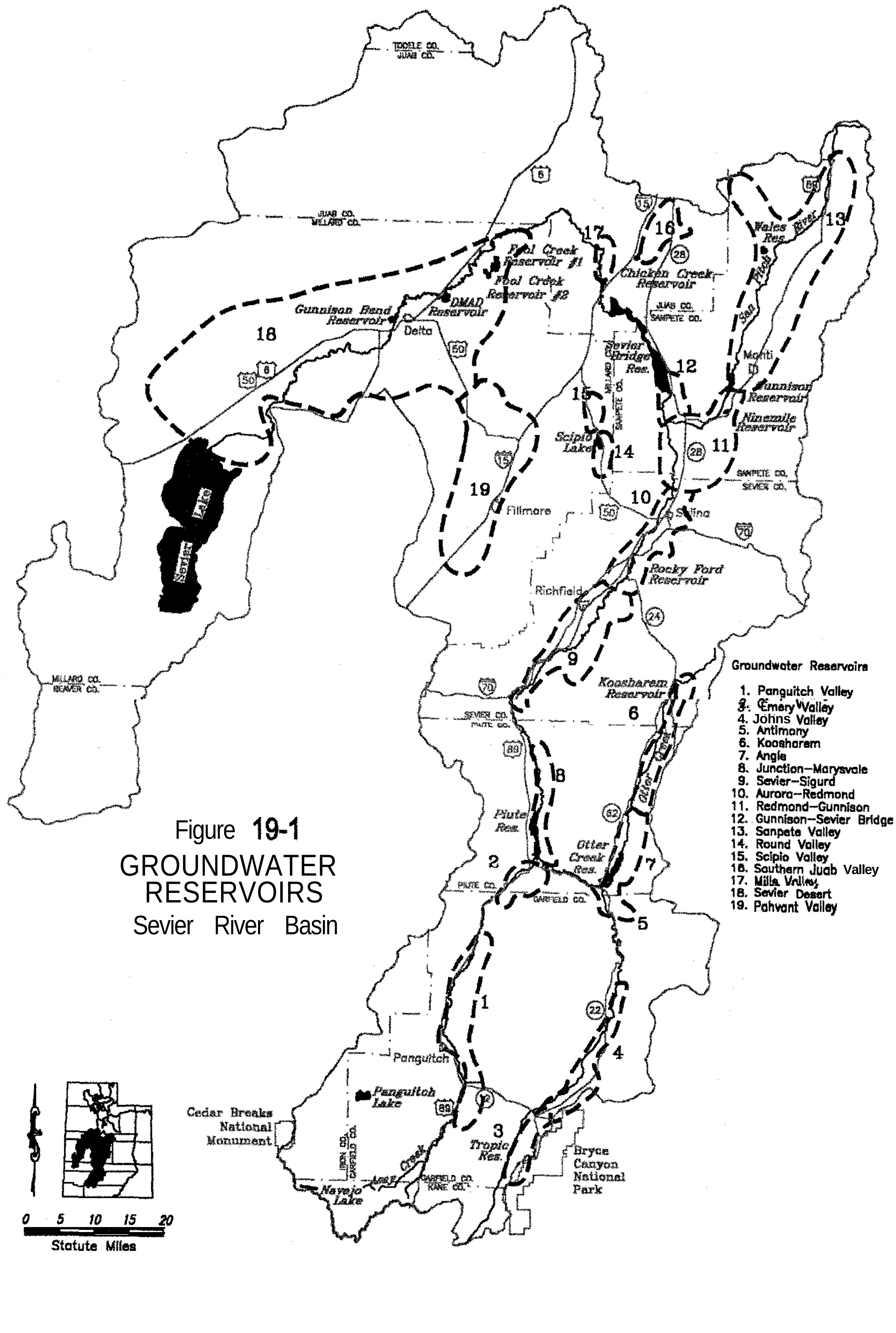


Figure 19-1
GROUNDWATER RESERVOIRS
Sevier River Basin

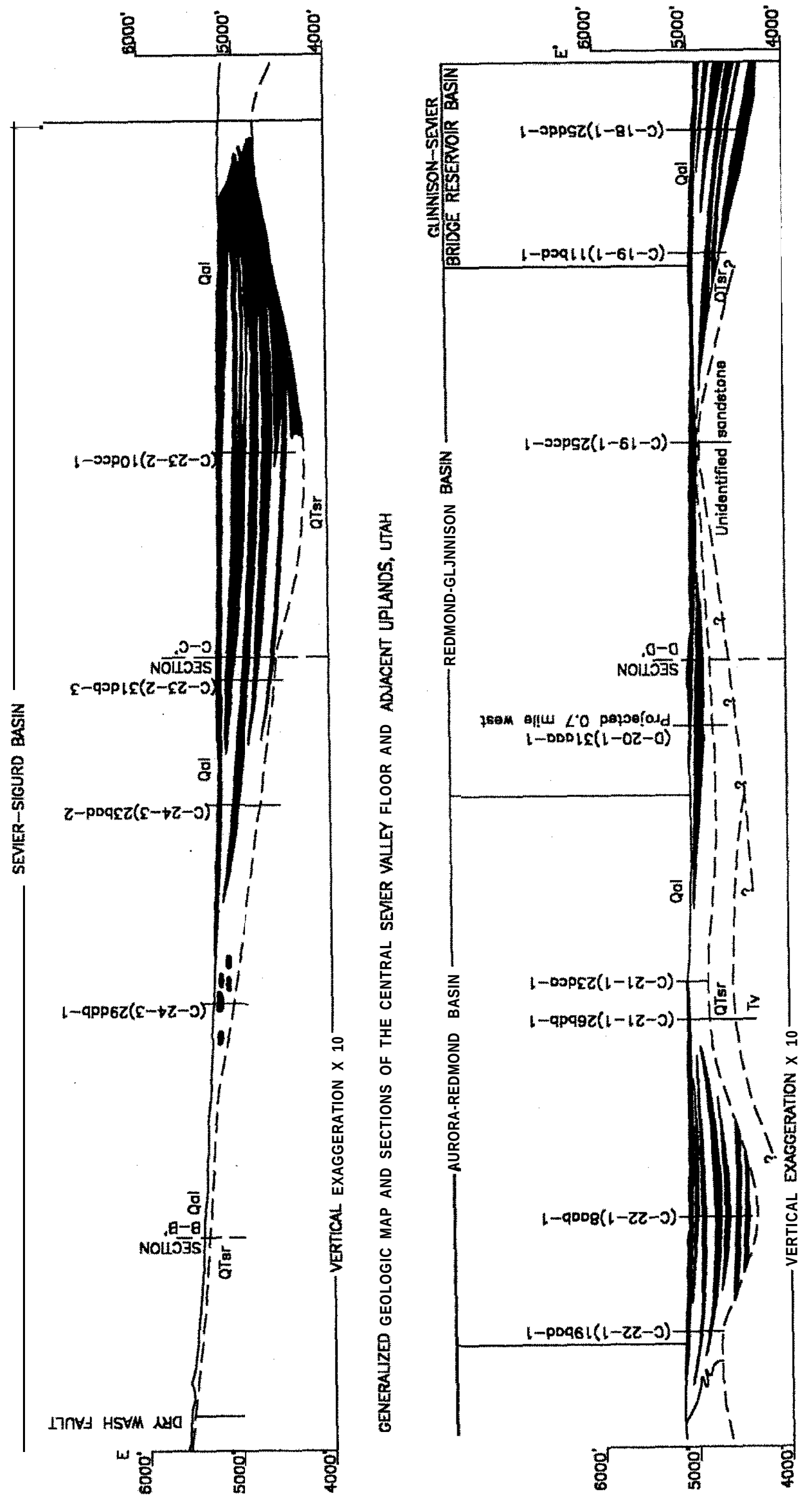


Figure 19-2
GROUNDWATER RESERVOIR X-SECTION
Sevier River Basin

Sand and Gravel

Silt and Clay

Source: USGS Water Supply Paper 1787

Table 19-l
SEVIER RIVER GROUNDWATER RESERVOIRS

Reservoirs	Storage (1,000 acre-feet)	Withdrawals (acre-feet/year)	Water Quality
Panguitch Valley	570	100	Very good
East Fork Valley[a]	90	120	Good
Grass Valley[b]	150	1,700	Good
Circle Valley	210	220	Good
Junction-Maryavale	30	Neg	Good
Sevier-Sigurd	800(3,000[c])	12,100	Good-fair
Aurora-Redmond	200	400	Good-fair
Redmond-Gunnison	150	4,500	Fair
Gunnison-Sevier Bridge	300	3,900	Fair-poor
Sanpete Valley	3,000	6,300	Good
Subtotal-above S.B.Reservoir	5,500		
Round Valley	d	2,800	Very Good
Scipio	d	100	Good
Southern Juab Valley	d	8,300	Good-fair
Mills	d	Neg.	Good-poor
Sevier Desert	200,000 e	31,000	Good-poor
Pahvant Valley	1,000	84,000	Good-poor
Total	206,500	155,540	

Source: U.S.G.S. studies during 1960s; Water Supply Papers, 1787, 1794, 1836, 1854 and 1896.
[a] Includes Emery Valley, Johns Valley and Antimony Subbasins.
[b] Includes Koosharem and Angle Subbasins.
[c] U.S.G.S. study 1986-90 published as Technical Publication 103.
[d] Storage estimates were not made.
[e] Technical Publication 79.

usually becomes a part of the groundwater reservoir. This water surfaces at the geologic restrictions on the lower end of the groundwater reservoir and becomes downstream surface-water flows.

Many irrigation companies, particularly in Circle Valley, the lower Sevier Valley, Sanpete Valley and the Mills area depend on return flows for water to divert into their systems. Also, a large share of the water stored in Sevier Bridge Reservoir comes from return flows.

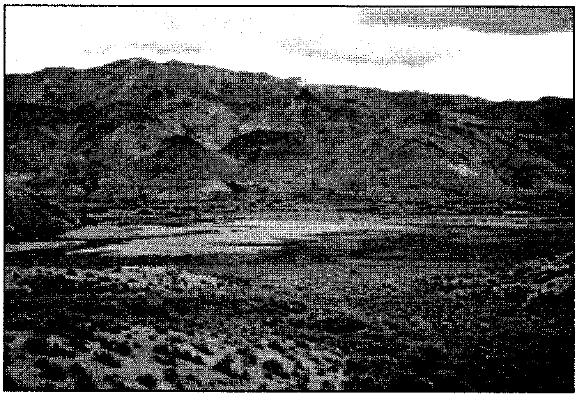
Model studies have indicated even though water is pumped, the reduction in groundwater basin outflow is less than the volume of withdrawals. This pattern is essentially the same in all of the groundwater reservoirs.

Groundwater movement in the valleys is continuous but with less short-term fluctuation than surface-water flows. Transwatershed groundwater flow is also important along the lower reaches of the Sevier River. The entire outflow from Scipio Valley is groundwater flowing through a system of en echelon faults and solution channels in the Flagstaff limestone to feed Mohlen and Blue springs on the Sevier River just below Yuba Dam. About 80 percent of the groundwater outflow from the Levan area becomes the surface water supply for the Mills area.

There is also groundwater flow out of and into the basin.[63] There is groundwater outflow of 6,800 acre-feet from the East Fork of the Sevier River into the Kanab Creek-Johnson Wash drainages. Groundwater outflows from the South Fork of the Sevier River are about 14,600 acre-feet to the Virgin River drainage on the south and to drainages along the Hurricane Cliffs from Cedar City to Paragonah. The groundwater outflow from Pahvant Valley to Clear Lake Spring was measured at 14,900 acre-feet during the period 1960-64 and 16,000 acre-feet during 1969-8 1.[40]

There is 6,700 acre-feet of groundwater inflow from the west side of the Gunnison Plateau near Nephi into the San Pitch River drainage. Nearly 11,000 acre-feet of groundwater flows from the Awapa Plateau in the Fremont River drainage into Antimony Creek.

The groundwater reservoirs are discussed in the following subsections. Most of the data comes from technical publications by the U.S. Geological Survey (USGS) and the Division of Water Bights and from USGS water supply papers and basic-data reports.


Groundwater supplies Taylor Pond

19.2.1 Panguitch Valley Basin[12,60]

Panguitch Valley groundwater reservoir is located between the mouth of Mammoth Creek and the head of Circleville Canyon. The Sevier fault forms the eastern boundary. The valley alluvial fill is about 830 feet thick. Panguitch Valley groundwater reservoir was formed by a geologic restriction of volcanic rock on the north between the Sevier Plateau on the east and the southern Tushar Mountains on the west. The Sevier River flows through this restriction into Circleville Canyon, a steep-sided gorge about five and one-half miles long.

The Wasatch (Claron) formation in the Markagunt Plateau is the predominant producer of groundwater and therefore influences the water quality in Panguitch Valley. The dominant ions are calcium, bicarbonate and magnesium. Sodium concentrations increase north of Panguitch because of the presence of volcanic rocks west of the valley. The groundwater in the northern end of Panguitch Valley has a lower concentration of dissolved-solids than the southern part. This is because the high-quality deep groundwater is forced up at the geologic restriction.

The surface water dissolved-solids concentrations ranged from 18.5 mg/L at Hatch to 318 mg/L at the confluence of Bear Creek and the Sevier River. Evidence indicates the surface water and groundwater are comparable in quality except in the valley mouth.

Groundwater was sampled during the early 1960s.[12] Data indicates the total dissolved solids in the Hatch area were about 175 mg/L. This increased to about 400 mg/L near Panguitch but dropped to about 250 mg/L east of Spry and 200 mg/L at the valley mouth.

Panguitch Valley stores about 570,000 acre-feet of water in the top 200 feet of alluvium. Annual pumpage was estimated at 49 acre-feet in 1962. There were 120 wells drilled between 1963 and 1989 with current withdrawals for public, domestic and livestock use of about 100 acre-feet. There are no large irrigation wells.

A model study by the U.S. Geological survey investigated the impact of increased groundwater use.[60] The study determined it may be possible to develop up to an additional 3,600 acre-feet of groundwater. This would take water away from some of the phreatophytes and partially dry up some of the wetter areas. There would also be some decrease in the flow of springs, streams and existing wells. After one year of increased use, return flows would decrease by about 500 acre-feet from predevelopment flows and by about 2,000 acre-feet after 12 years.

19.2.2 Circle Valley Basin[12,60]

The Circle Valley Basin is located between the mouth of Circleville Canyon and a bedrock restriction west of Kingston. The basin was formed by en echelon faulting in the surrounding volcanic rocks. It is bounded on the east by the Sevier Plateau and on the west by the southern

Tushar Mountains. The alluvium is estimated to be 680 feet thick.

The Circle Valley groundwater quality is indicated by a well about 2 miles northeast of Circleville where the dissolved-solids concentrations are 473 mg/L. Circleville Spring, about 5 miles northwest of the well, has dissolved-solids concentration of 85 mg/L. This indicates the difference between valley fill groundwater quality and water issuing from volcanic rocks.

Groundwater storage is estimated at 210,000 acre-feet in the upper 200 feet of alluvium. Annual pumpage was about 540 acre-feet in 1962, 500 acre-feet of which was for irrigation. There were 13 wells drilled between 1963 and 1989. Groundwater withdrawals from wells is now about 223 acre-feet per year, 200 acre-feet from two irrigation wells. The use of one large well producing 500 acre-feet in 1962 was discontinued.

19.2.3 East Fork Valley Basin [12,60]

The East Fork Valley subbasins are between Tropic Reservoir and the upper end of Kingston Canyon. There are three separate basins in this reservoir system formed by two bedrock restrictions. Annual withdrawals from wells are estimated at 124 acre-feet, mostly for public water supplies in Emery Valley.

Emerv Vallev Subbasin - Emery Valley Subbasin covers about 12,000 acres between Tropic Reservoir and Flake Mountain. Part of the subbasin is bounded by a fault on each side. The valley was formed from an eroded horst. The maximum known thickness of the alluvial aquifer is 66 feet.

Johns Valley Subbasin - Johns Valley Subbasin lies between Flake Mountain and the head of Black Canyon and covers about 30,000 acres. The volcanic bedrock at the head of Black Canyon extends out from the Aquarius Plateau and the Sevier Plateau, restricting the groundwater outflow and forming the groundwater reservoir. The maximum known thickness of the valley alluvium is 360 feet. The groundwater reservoir contains about 90,000 acre-feet of water.

Small flows running through these two subbasins tend to infiltrate into the water table and eventually feed the groundwater reservoir. This supplies the dense stands of Artemisia tridentata (big sagebrush) and Chrysothamnus spp. (rabbit brush). As a result, only large flows contribute to the downstream supply of the East Fork of the Sevier River. For this reason, the Tropic and East Fork Irrigation Company is required to release the Otter Creek Reservoir Company storage rights in large volumes. This insures more of the released flows reach Otter Creek Reservoir. This was a source of contention between the two companies in past years but has been resolved by an operations agreement.

The only available water quality data is from Tom Best Spring with dissolved-solids concentrations of 233 mg/L. This spring is on the west slopes of the valley which are made up of volcanic rocks.

Antimonv Subbasin - Antimony Subbasin includes about 6,000 acres between the mouth of Black Canyon and the upper end of Kingston Canyon. This area is bounded by the volcanic bedrock of Black Canyon, Sevier Plateau, Aquarius Plateau, the bedrock at the head of Kingston Canyon and the Grass Valley subbasin. The maximum known thickness is 201 feet of alluvium.

19.2.4 Grass Valley Basin[12,60]

The Grass Valley subbasins cover the area between the low divide separating Otter Creek from Peterson and Lost creeks on the north and the head of Kingston Canyon on the south. It includes the Koosharem and Angle subbasins. The Grass Valley groundwater reservoir contains about 150,000 acre-feet of water. The annual withdrawals from wells are estimated at 1,700 acre-feet, mostly flowing wells for irrigation and livestock use.

Koosharem Subbasin - The Koosharem Subbasin runs from the divide above Koosharem Reservoir to the bedrock restriction below Greenwich, covering about 30,000 acres. It is bounded by the Sevier Plateau on the west and the Awapa and Fish Lake plateaus on the east. It is a graben with a maximum thickness of 770 feet of alluvium.

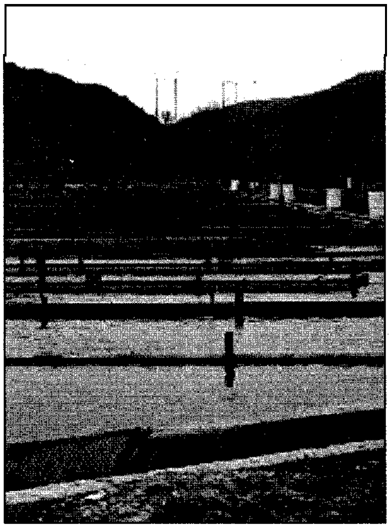
The water quality was tested in one well just north of Koosharem. The dissolved-solids concentration was found to be 148 mg/L.

Angle Subbasin - The Angle Subbasin covers about 20,000 acres between the bedrock restriction forming 'The Narrows" above Angle and the head of Kingston Canyon. It is a graben formed by the Paunsaugunt fault and Awapa Plateau on the east and the Sevier Plateau and an unnamed fault on the west. The maximum known thickness of alluvium is 490 feet.

19.2.5 Central Sevier Valley Basin[39,79]

The Central Sevier Valley is made up of five groundwater basins: Junction-Marysvale, Sevier-Sigurd, Aurora-Redmond, Redmond-Gunnison and Gunnison-Sevier Bridge Reservoir. (Figure 19-1).

The Central Sevier Valley is a synclinal trough modified by a graben formed by the two largest faults in the area: the Sevier fault on the east and Elsinore fault on the west. The Tushar fault is present in the southern part of the valley. These faults are probably responsible for the springs along the east and west edges of the valley such as Bamson Springs, Black Knoll Spring, Cove Spring, Glenwood Springs, Richfield Spring and Redmond Lake Spring. The five groundwater basins have been formed by faulting, volcanism, intrusions and stream action. The Sevier River has deposited more than 800 feet of alluvium in some areas, forming the groundwater reservoirs.



Supplied by alluvial springs

The groundwater quality generally decreases as the water moves from the Junction area to Sevier Bridge Reservoir although there is good quality water at various locations throughout this reach. About 60 percent of the samples in the Sevier to Redmond area tested less than 590 mg/L (1,000 μS/cm) while only about 25 percent in the Redmond to Sevier Bridge Reservoir area was less.

Part of this increased contamination comes from over irrigation and precipitation and part comes from the Arapien shale. Groundwater satisfies all types of uses including culinary, irrigation, industrial, stock water, recreation and environmental demands.

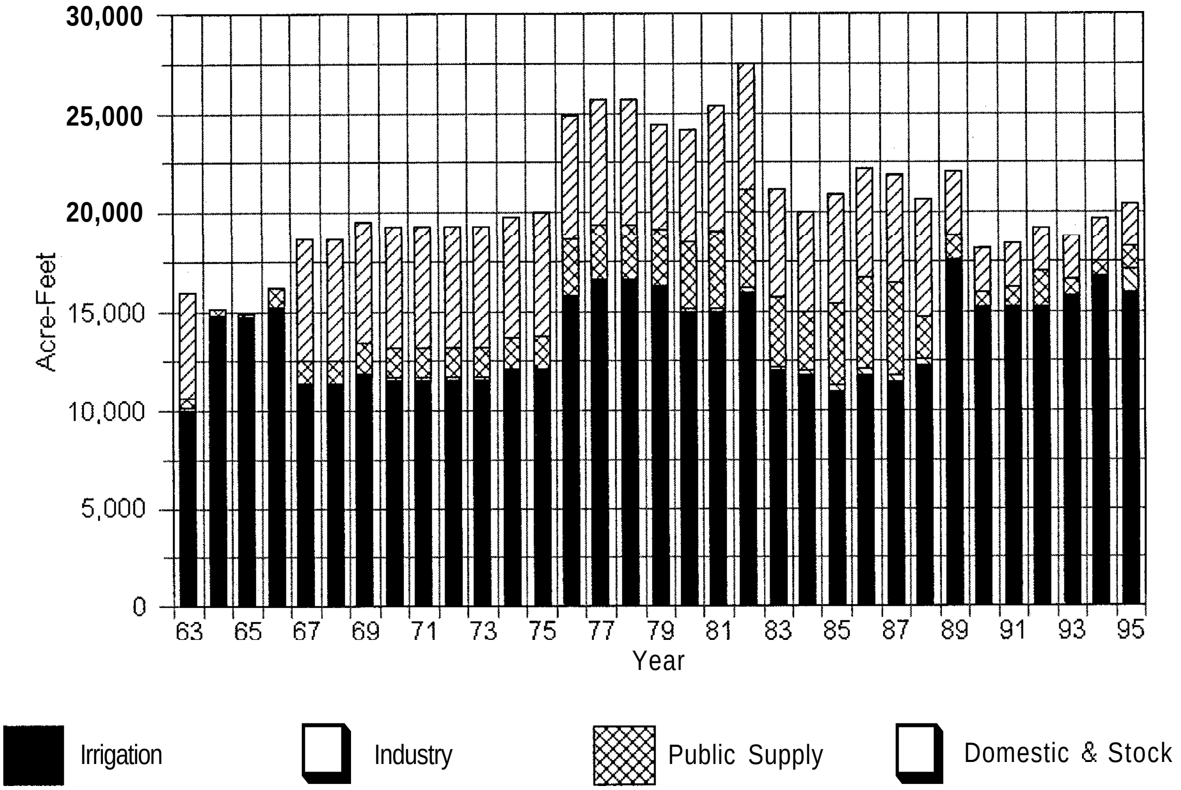
Groundwater in the Central Sevier Valley Basin is less suitable for culinary water supplies than in upstream areas. Only half of the wells tested did not exceed the recommended drinking water standards. Public water supplies in the Redmond-Gunnison basin are less likely to meet the higher domestic water standards. The majority of the samples tested were classed as very hard. Hardness is also a measure of the suitability of water for domestic purposes. Water from unfaulted Tertiary volcanic rocks was softer than from any other formation.

Irrigation water quality is classified using indices of salinity (total dissolved-solids)and sodium hazard. In the Central Sevier Valley, springs provide the best quality of water for irrigation. In general, wells greater than 100 feet deep yield water of better quality for irrigation than do wells less than 100 feet deep. The majority of the wells deeper than 100 feet tested medium salinity hazard while wells less than 100 feet deep were high or very high salinity hazard. Most of the wells at all depths had a low sodium absorption ratio with the deeper wells having less sodium. Although the overall quality of water tends to deteriorate in a downstream direction, it appears good quality groundwater is available for irrigation except in the Redmond-Gunnison basin where the water is slightly to moderately saline. Groundwater withdrawals from wells during 1963-95 are shown in Figure 19-3.

Junction-Marvsvale Groundwater Subbasin[79] The Junction-Marysvale Subbasin runs from the mouth of Kingston Canyon to the head of Marysvale Canyon. The basin is divided by a bedrock restriction in the valley near Piute Dam. The area

Figure 19-3

Central Sevier Valley
ESTIMATED WITHDRAWAL FROM WELLS



above Piute Dam covers about 2,000 acres and the known depth of the alluvium is only 80 feet.

The groundwater basin below Piute Dam runs to the head of Marysvale Canyon, an area about 12 miles long and from 300 feet to 5,000 feet wide. The maximum thickness of the alluvium is not known.

The groundwater storage in the upper 100 feet of alluvium was estimated at 30,000 acre-feet in 1960.[79] The total withdrawals were small from 28 wells pumped for stock water use in 1960.

The groundwater is generally suitable for all uses as it has less than 295 mg/L (500 µS/cm). Most wells have calcium and bicarbonate as the predominant ions. Some areas produce water with a pH less than 6.0 which is unsuitable for domestic usewithout treatment. Fluoride is found in some water in excess of the recommended amount for domestic use. Local dentists have reported the incidence of tooth decay is much less here than in other areas with less concentration.

Sevier-Sigurd Groundwater Subbasin - This subbasin runs from the mouth of Marysvale Canyon near the town of Sevier to Rocky Ford Dam near Sigurd. The geologic restriction near Sigurd is formed by lava on the east and an uplifted block on the west. The graben formed basin is 25 miles long and from 2 to 5 miles wide. The alluvium increases in thickness from a feather edge at the mouth of Marysvale Canyon to 800 feet near Venice, then decreases to 280 feet west of Rocky Ford Reservoir.

The areal extent of the groundwater reservoir is about 62,000 acres and the average thickness of the water-yielding material is about 240 feet. Total groundwater storage is about 3.0 million acre-feet. (This value is from a 1986-90 U.S.G.S. study. A 1960 study indicated 800,000 acre-feet of storage in the upper 200 feet of alluvium.)

U.S. Geological Survey studies[39] have indicated increased withdrawals from wells of 25,000 acre-feet would reduce all types of discharge but the largest impact would be a reduction of return flow to the Sevier River by about 4,800 acre-feet (See Section 9.5.2). Other studies have indicated these withdrawals would have the least impact on the river if wells were drilled between Central Valley and Sigurd.

The groundwater reservoir is recharged by infiltration of precipitation, seepage from canals and the Sevier River, deep percolation from irrigation, and tributary groundwater inflow. The total recharge is estimated at 112,700 acre-feet. The recharge by components is shown in Table 19-2.

Discharge from the groundwater reservoir is by seepage to the Sevier River, evapotranspiration, springs, wells (pumped and flowing), drams and subsurface outflow. The discharge from pumped wells and evaporation occur throughout the area. The balance of the discharge is mostly in the northern half of the basin. The discharge is shown in Table 19-2.

Groundwater in the Sevier-Sigurd basin is generally suitable for all uses although there are some exceptions. The deeper wells generally produce the highest quality water. The Monroe Hot Springs and the Joseph Hot Springs are highly mineralized and are not representative of the groundwater in general. These hot springs come from the Sevier fault and from the Elsinore fault, respectively.

The water quality in the Sevier-Sigurd Subbasin generally deteriorates from south to north and is influenced by inflow from consolidated rocks and tributary streams. Calcium and magnesium bicarbonate dominate in the south half and along the west margin from Richfield to Sigurd. These come from seepage of irrigation water and inflow from consolidated-rock. Sulfate becomes more dominant east of Richfield and south of Sigurd. This water has a specific conductance 2 to 4 times that of water where bicarbonate is the anion.

Groundwater northwest of Monroe had dissolved solids of 425 mg/L (725 µS/cm). One well, two and one-half miles south -southwest of Richfield had dissolved solids between 295 mg/L and 415 mg/L (500 and 700 µS/cm) while wells closer to town and to the south were up to 2,360 mg/L (4,000 µS/cm). This difference may be the influence of higher quality water in the river as opposed to deep percolation from irrigation. Groundwater near Sigurd shows dissolved solids from 415 mg/L to 885 mg/L (700 to 1,500 µS/cm) indicating the influence of poorer quality water

Table 19-2 GROUNDWATER RECHARGE/DISCHARGE-SEVIER TO SIGURD	
Source	Annual Recharge (acre-feet)
Infiltration of precipitation	2,100
Seepage from canals	8,900
Seepage from Sevier River	10,100
Seepage from tributary streams	19,200
Groundwater inflow and irrigation deep percolation	72,400
Total	112,700
Source	Annual Discharge
Seepage to Sevier River	47,400
Evapotranspiration	23,200
Springs	18,000
Wells	12,100
Drains	10,000
Subsurface outflow	2,000
Total	112,700

lower downstream along the Sevier River as opposed to tributary inflow sources.

Aurora-Redmond Groundwater Subbasin - This groundwater basin is nine miles long and averages three miles in width. Maximum thickness of the alluvium is 660 feet east of Aurora. This basin contains three distinct layers of clay deposited by the Sevier River and its tributaries. The clay layers were deposited in lakes or ponds created by a restriction formed by the Redmond Hills anticline. Groundwater storage is about 200,000 acre-feet in the top 200 feet of alluvium.

Recharge comes from precipitation, seepage from canals and the Sevier River, deep percolation of irrigation water and tributary groundwater inflow. Water is diverted from the Sevier-Sigurd Subbasin into the Piute and Vermillion canals, part of which is delivered to this subbasin. Groundwater inflows from Salina Creek and Lost Creek were estimated at 150 acre-feet and 75 acre-feet, respectively. These discharges produce large amounts of saline contaminants as the water moves through the Arapien shale.

The groundwater discharge is from evapotranspiration, well withdrawals, gains to the Sevier River and springs. These discharges occur throughout the basin. Well withdrawals are estimated at 400 acre-feet used for municipal and industrial, domestic and stock water supplies.

Most of the groundwater in the Aurora-Redmond Subbasin is generally suitable for all types of use. The deeper wells produce the better quality water. The wells on the east side of the basin are near the Arapien shale and as a result produce poorer quality water.

One well at the north edge of Aurora yields water at about 340 mg/L (580 µS/cm). Groundwater from a well about one and one-half miles south-southeast of Redmond is about 440 mg/L (750 µS/cm) while a well one mile west-southwest is about 710 mg/L (1,200 µS/cm). The first is near the Sevier River and the latter is near Redmond Spring.

Redmond-Gunnison Groundwater Subbasin - The Redmond-Gunnison groundwater basin is a Y-shaped depression running from the Redmond Hills northward with one branch extending northwesterly down the Sevier Valley about three miles toward Sevier Bridge Reservoir. The other branch extends about 7 miles up the San Pitch River to Gunnison Reservoir dam. The basin is 12 miles long and ranges from three to eight miles in width. The basin alluvium ranges in thickness from 250 feet thick in the Willow Creek fan to 120 feet west of Centerfield and 320 feet west of Gunnison. The basin alluvial fill stores about 150,000 acre-feet in the upper 200 feet.

Groundwater withdrawals are about 4,500 acre-feet. Of this amount, about 4,200 acre-feet is used for irrigation and the balance for municipal and industrial purposes.

The Redmond-Gunnison Subbasin groundwater is lower in quality than the upstream subbasins. Groundwater in the Axtell area and in the northwestern part of the subbasin is of quality acceptable for most uses, mostly irrigation. The remainder of the subbasin produces water with higher salinity and is unsuitable for domestic uses. This is due to mineral constituents dissolved from the Arapien shale.

One well near Axtell produces water with dissolved solids of 2,270 mg/L (3,850 μS/cm). The groundwater quality in the Gunnison area ranges from about 1,300 mg/L (2,200 μS/cm) on the east side of the valley to about 1,535 mg/L (2,600 μS/cm) on the west near the Sevier River.

<u>Gunnison-Sevier Bridge Reservoir Subbasin</u> - This subbasin extends from midway between Gunnison and Fayette to Yuba Dam. It is about 18 miles long and averages 3 miles in width. This groundwater reservoir is divided into two subbasins, one above and one below the Sevier Bridge Reservoir narrows which is midway between Fayette and Yuba Dam.

The alluvium was deposited by a lake formed by a bedrock restriction across the valley at the Sevier Bridge Reservoir narrows. The alluvium thickness varies from a thin veneer near the narrows to 500 feet near Fayette and 320 feet northwest of Gunnison. Little is known about the extent, thickness or characteristics of the groundwater reservoir in the lower subbasin as it is typically covered by water stored in Sevier Bridge Reservoir. The estimated groundwater in storage is 300,000 acre-feet.

Irrigation is the only suitable use for most groundwater in the Gunnison-Sevier Bridge Reservoir Subbasin because of the chemical quality. Well water from a deeper aquifer is of a higher quality. Total annual withdrawals from wells is about 3,900 acre-feet with about 3,500 acre-feet used for irrigation.

<u>Recharge-Discharge: Aurora to Sevier Bridge Reservoir</u> - It was difficult to determine the recharge-discharge relationships for each of the five groundwater subbasins in the Central Sevier Valley. Even a broader basis, some of the items were lacking in data. Broad estimates have been made of the recharge and discharge for the three northern subbasins; Aurora-Redmond, Redmond-Gunnison and Gunnison-Sevier Bridge Reservoir. These are shown in Table 19-3.

19.2.6 Sanpete Valley Basin[76]

Sanpete Valley is Y-shaped and about 40 miles long and up to 13 miles wide. The west branch of the Y runs from Moroni toward Fountain Green and the east branch runs up to Fait-view. The Arapien Valley extends southward from the lower end of Sanpete Valley and is about 8 miles long and one mile wide. These two valleys are bounded on the east by the Wasatch monocline. On the west, Sanpete Valley is bounded by the Gunnison Plateau and the Arapien Valley is bounded by low hills with a drainage divide on the south. The valley till thickness varies from about 100-350 feet in the Mt. Pleasant-Fait-view and Moroni- Fountain Green areas to 100-500 feet in the Ephraim-Manti area. Generally the valley fill is thicker on the west side, probably influenced by the Sevier fault. The wells on the east side of the valley are under water table conditions. The wells on the west are under artesian and water table conditions.

Most of the groundwater is stored in the alluvium in the valley fill. There is an estimated three million acre-feet of water stored in the upper 200 feet of valley fill in Sanpete Valley above the Gunnison Reservoir dam. Of this amount, about 600,000 acre-feet is in the top 30 feet of saturated material and 400,000 acre-feet is in the 30 to 50-foot zone. There is 800,000 acre-feet in the underlying 50 feet and 1.2 million acre-feet in the 100 to 200-foot zone.

Table 19-3
GROUNDWATER RECHARGE/DISCHARGE-AURORA TO SEVIER BRIDGE RESERVOIR

Source	Annual Recharge (acre-feet)
Precipitation (5%[a])	4,900
Sevier River losses	1,500
Groundwater inflow	2,400
Other recharge[b]	135,000
Total	143,800
Source	**Annual Discharge**
Evapotranspiration	24,000
Well withdrawals	7,400(8,800[c])
Discharge to Sevier River	85,000
Springs	27,000
Total	143,800

[a] Only 5 percent of the precipitation was considered effective.
[b] Other recharge includes deep percolation from irrigation, groundwater inflow-Sanpete Valley, other groundwater inflow.
[c] Separate study estimate.

Recent studies simulated increasing the present well withdrawals from 6,300 acre-feet to 18,900 acre-feet over a 5-year drought period using a recharge at 75 percent of average. Discharge as seepage to the San Pitch River decreases from 17,200 acre-feet to between 13,200 and 16,000 acre-feet. Discharge from alluvial springs decreases 3,600 acre-feet to between 2,400 and 3,100 acre-feet.

Groundwater Recharge - There are four sources where recharge to the groundwater reservoir has been estimated. These are tributaries, San Pitch River, deep percolation of unconsumed irrigation water and precipitation.

Seepage from the tributaries occurs where the streams flow across the alluvial fans. Up to 38 percent loss has been measured on Twin Creek, 10 percent on Ephraim Creek and 9 percent on Oak Creek near Spring City.

Seepage from the river varies throughout its length. There are areas of gain as well as loss. Measurements made of gaining and losing reaches determined the net recharge to the river.

Recharge from deep percolation of unconsumed irrigation water was estimated at 29,000 acre-feet or about 0.5 feet per acre. Deep percolation has decreased over the years as more sprinkler systems have been installed. Between 1975 and 1989, sprinkler irrigation increased from about 10 percent of the irrigated land to over 50 percent.

Precipitation is a significant part of the recharge to the groundwater reservoir. Based on other studies in Utah, recharge is estimated at 10 percent of the annual precipitation. The recharge to groundwater is shown in Table 19-4.

Groundwater Discharge - There are four principal sources of discharge from the groundwater reservoir. These are evapotranspiration, seepage to the San Pitch River, springs and withdrawals from wells.

The evapotranspiration rates were based on several studies in other areas and at different times in Sanpete Valley. The range in gain to the San Pitch River is from two different studies completed during October and April in two different years. The water pumped from wells indicates the high and low years over the 33-year period. The volume of water from flowing wells tends to remain constant. The discharge from springs is almost constant although some springs were not included because measurements were not available. Withdrawals from wells during 1963-95 are shown in Figure 19-4. The discharges from groundwater are shown in Table 19-4.

The groundwater is generally of better quality near the boundary between the valley fill and the mountain fronts of the Wasatch Plateau and San Pitch Mountains. This is the area where snowmelt runoff enters the valley across alluvial fans.

The concentration of total dissolved-solids (TDS) varies throughout the valley. In many areas in the central part of the valley, the TDS is less than 500 mg/L. TDS over 500 mg/L is present in the northwestern, central and extreme southern part of the basin.

Water with higher specific conductance is generally concentrated in two areas of the valley. One area is downgradient from outcrops of the Green River and Crazy Hollow formations of Tertiary age in the central part of the valley from Chester to Pigeon Hollow. This water is generally less than 200 feet below the surface. The other area is downgradient from outcrops of the Arapien shale on the west and south side of the valley from near the Point of the Mountain (Big Mountain) southward to near the mouths of Axehandle and Rock canyons.

Water from the majority of wells in the valley fill has a dissolved-solids concentration less than 600 mg/L and specific conductance less than 1,000 µS/cm. The water is composed of calcium, sodium, magnesium and bicarbonate ions which are typical of most of the groundwater from the valley fill.

The water from Big Springs west of Fountain Green is a calcium carbonate type with a dissolved solids concentration of only 255 mg/L (430 µS/cm) although Birch Spring three miles south has dissolved solids of 470 mg/L (800µS/cm). This good quality water is indicative of most of the groundwater flow through the Indianola formation. The series of springs from about Fountain Green to the Point of the Mountain are from groundwater movement through the Indianola formation from the west side of the mountain.[63] Most of these springs all have dissolved-solids less than 355 mg/L (600 µS/cm). In contrast, a spring discharging water from a fault zone southwest of Manti contains sodium bicarbonate, sulfate and chloride ions. Dissolved-solids concentrations are much higher at 1,780 mg/L.

Ground-water quality for Sanpete Valley is generally very good, although locally, elevated total dissolved-solids (TDS) and nitrate concentrations exist in the valley-fill aquifer. The Utah Geological Survey mapped water quality in the valley-fill aquifer to ascertain possible nitrate pollution documented in previous investigations. Water-well samples were collected and analyzed during the summer and autumn of 1996 and spring of 1997 to evaluate TDS and nitrate concentrations. Water wells representing a widespread geographic distribution in the valley-fill aquifer, were analyzed for nutrients (nitrate, nitrite, ammonia, and phosphate). Of those, 120 were tested for general chemistry, and 52 for organics (including pesticides).

Nitrate values range from <.02 mg/L to 45.3 mg/L. Eighty-eight percent of the wells analyzed for nitrate yielded values less than 5 mg/L. Three percent of the water wells analyzed showed high nitrate values (those which exceeded Utah drinking-water standards of 10 mg/L). Preliminary data indicate half of the high-nitrate wells are impacted by diffuse non-point sources, not nitrate plumes. Most of the high-nitrate wells are shallow (<200 feet deep) and/or in primary recharge areas. Three percent of the water wells tested for pesticides yielded values above the detection limit,

Figure 19-4

Sanpete Valley

ESTIMATED TOTAL WITHDRAWAL FROM WELLS

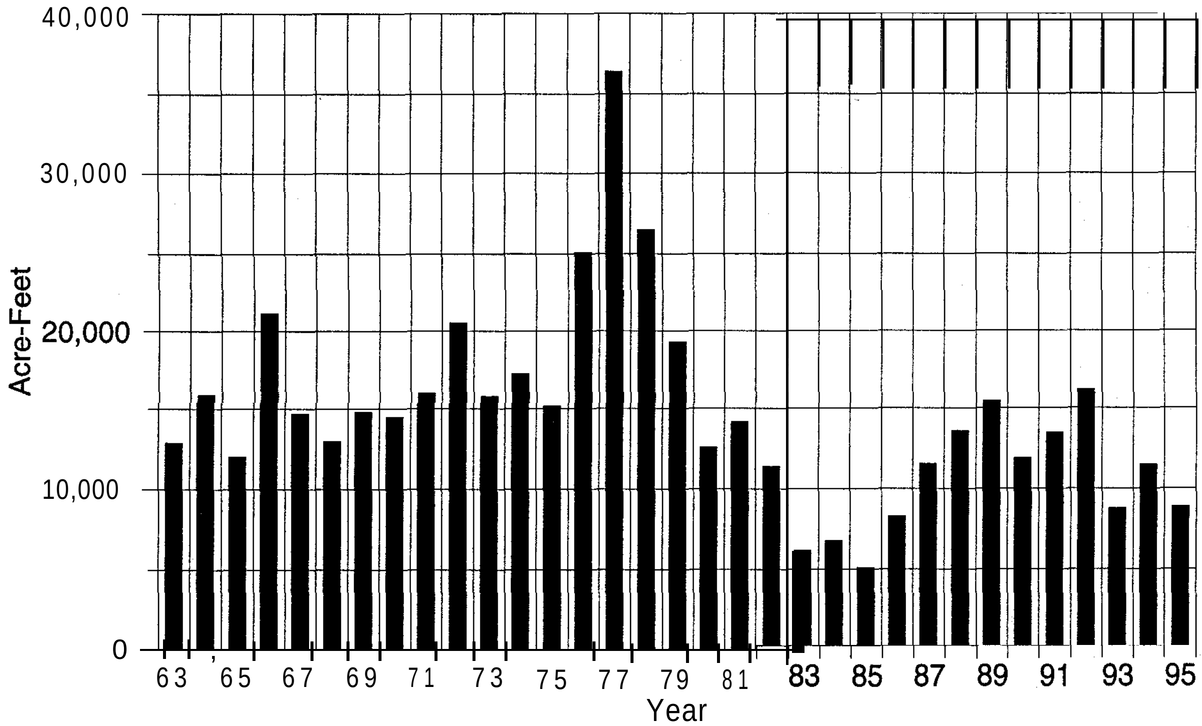


Table 19-4 GROUNDWATER RECHARGE/DISCHARGE-SANPETE VALLEY	
Source	Annual recharge (acre-feet)
Seepage from tributaries	28,500-57,000
Seepage from San Pitch River	1,500-l ,800
Deep percolation-irrigation water	29,000
Precipitation	15,000
Total (rounded)	74,000-103,000
Source	Annual Discharge
Evapotranspiration	41,000-l 16,000
Seepage to San Pitch River	18,500-80,300
Wells	
Pumped (1963-88)	1,200-12,800
Flowing (1965-657, 1989)	4,000
Alluvial springs	11,000
Total (rounded)	76,000-224,000

but at levels below Utah drinking-water standards. Total dissolved-solids concentrations determined for 70 percent of the wells tested for general chemistry are below 500 mg/L, with a range of 226-2,572 mg/L. Overall water quality in the valley-fill aquifer is Class IA (pristine drinking water), the highest quality classification for water in Utah.

Potential sources of nitrate contamination include fertilizer, manure associated with feed lots (cattle, turkeys, chickens and sheep), and septic tanks. Elevated levels of TDS concentrations in ground water are attributed to the proximity of outcrops of the Green River formation in the central part of the valley, and to the Arapien shale in the southern part of the basin.

19.2.7 Round and Scipio Valleys Subbasins"

Scipio Valley and Round Valley are graben basins, bounded on the east by the Valley Mountains and on the West by the Pahvant Range and Canyon Mountains. High angle normal faults traverse Scipio Valley in a northeasterly direction. Movement along several of these faults has exposed bedrock which forms the Low Hills. This is also the northern basin boundary making Scipio Valley a closed basin. These faults have led to solution channels which provide underground drainage out of the valley and through Little Valley. These channels provide the source of water for Mohlen and Blue springs under the Sevier River below Yuba Dam.

Round Valley Subbasin - Groundwater in Round Valley occurs mainly under artesian conditions. There are three large flowing wells that tap permeable zones in the sandstone. They discharge 1,300-1,800 gallons per minute (gpm). Groundwater also occurs under water table conditions around the edge of the valley. Water samples taken in Round Valley during 1963 were 300 mg/L (510 µS/cm) and 374 mg/L (634 µS/cm).

Scinio Vallev Subbasin - Groundwater occurrence in Scipio Valley is unusual as the water levels change abruptly near the middle of the valley. In the southern part of the valley, water levels are about l-50 feet below the land surface. The source of water is mostly seepage from Round

Valley Creek and/or irrigation water. About two miles north of Scipio, the water levels drop abruptly to more than 200 feet. The source of water is probably recharge on alluvial fans from precipitation and tributary runoff. There may be a deeper aquifer at this same level in the southern part of the valley. Samples taken during 1963 in Scipio Valley just northeast of Scipio varied from 221 mg/L (375 μS/cm) to 553 mg/L (938 μS/cm). One well six miles north of Scipio near the Low Hills contained 1,233 mg/L (2,090 μS/cm).

19.2.8 Southern Juab Valley Basin[11,55,59]

Juab Valley is a north-trending long, narrow valley divided into the northern and southern parts by the Levan Ridge, an east-west trending topographic divide which is also part of the northern boundary of the Sevier River Basin. Southern Juab Valley is bounded by the San Pitch Mountains on the east and the West Hills and South Hills on the west. This part of the valley is about 16 miles long and 2 to 6 miles wide. Juab Valley is downfaulted along the Wasatch fault on the east. Data indicates the valley is bounded on the west by inferred, smaller normal faults which intersect the Arapien shale at depth.

Chicken Creek is the primary stream supplying Southern Juab Valley with a smaller amount flowing from Pigeon Creek. These streams do not normally reach Chicken Creek Reservoir during the irrigation season except during high-runoff years because of diversions for irrigation. However, groundwater is discharged to seeps and springs near the reservoir. Chicken Creek Reservoir stores groundwater discharge and high-flow runoff. This water is used for irrigation in the Mills area, about four miles to the south.

The depth of the basin-fill deposits is not known but seismic-reflection data indicates it may be about 1,200-2,300 feet. For this discussion, the depth i.s considered to be 1,000 feet. The recharge and discharge for Southern Juab Valley was determined from average annual data based on the period 1963-93. The evapotranspiration data was based on the average irrigated acreage for 1990-92. The reason for this was because the irrigated acreage of 3,900 acres in 1969 had nearly doubled by the 1990s. In addition, 12 irrigation wells had been added in the Levan area since 1963. The annual recharge and discharge from the groundwater basin are shown in Table 19-5.

Water Quality - Groundwater entering southern Juab Valley is high in calcium and sulfate, picked up from the Arapien shale. Total dissolved-solids concentrations ranged from 623 mg/L at a well near Levan to 3,980 mg/L at a well about five. miles north of Chicken Creek Reservoir. There is a plume of groundwater extending from Chicken Creek toward Chicken Creek Reservoir where dissolved-solids concentrations are less than 1,000 mg/L. Palmer Spring, located under the northeast end of Chicken Creek Reservoir, contains 3,180 mg/L of dissolved-solids. Groundwater from the flow path supplying this spring is south of the Chicken Creek flow path and is probably less transmissive, allowing longer contact with soluble salts in the alluvium.

19.2.9 Mills Valley Subbasin"

Groundwater occurs under both water table and artesian conditions. Water table conditions occur along the margins while artesian conditions are found at depth beneath the flood plain. The supply for Chase Spring comes from alluvium or possibly from the underlying bedrock. The Meadows is a swampy area northwest of Chase Spring which contains many small springs and seeps.

Total annual groundwater discharge in the area is about 2,000 acre-feet, coming mostly from seepage from irrigation practices to the east. Two wells were sampled in 1963 within one mile of each other at depths of 359 feet and 465 feet. The deeper well contained 797 mg/L (1,350 μS/cm) while the other contained 337 mg/L (571 μS/cm). Chase Spring contained 1,127 mg/L (1,910 μS/cm).

19.2.10 Sevier Desert Basin[26,35]

The Sevier Desert area is bounded on three sides by steep, rugged mountains. These are the East Tintic Mountains and Canyon Range on the east, West Tintic, Sheeprock, Simpson, Keg and Desert mountains on the north and the Drum and Topaz mountains and House Range on the west. See Figures 3-1 and 19-1.

In the Sevier Desert, there is no distinct groundwater reservoir boundary as the water is moving across the broad delta in a west to southwesterly direction. There are two primary aquifers, one shallow and one deep.

Water enters the Sevier Desert groundwater basin from the surrounding mountains as well as the northwesterly flow from Pahvant Valley. Some of the groundwater comes from the Sevier River and there is some inflow from the Beaver River drainage. Other recharge is by infiltration of precipitation, seepage from streams, canals and reservoirs, and deep percolation of irrigation water. Recharge is estimated in Table 19-6.

Discharge from the unconsolidated basin fill is from seepage to the Sevier River, evapo-transpiration, groundwater outflow with ultimate discharge into Sevier Lake, and wells. Estimated discharge is shown in Table 19-6.

There is an area of 1.28 million acres or 2,000 square miles containing water in storage in the alluvial aquifers. Saturated deposits containing fresh water extend to a depth of about 1,300 feet near Lynndyl. The depth of the alluvium varies but it is estimated to exceed 1,000 feet in the central part of the basin. Total storage is estimated at 200 million acre-feet. Although most of the water is fresh, there is poor quality water in the low-lying central part of the basin.

The water quality varies from 200 mg/L total dissolved-solids (TDS) in a well just west of DMAD Reservoir to 49,000 mg/L TDS in a well north of Sevier Lake. The highest quality water is from wells deeper than 500 feet in the Lynndyl-Delta area. Poorer quality water comes from wells less than 200 feet deep in the southwestern part of the basin toward Sevier Lake. This is indicative of the contamination of the more shallow aquifers downstream by return flows from cropland drains and leaching of salts.

Groundwater quality has deteriorated over the years in the Leamington-Lynndyl area. Discharges have increased in concentrations of sodium and potassium from 241 mg/L to 316 mg/L and chloride from 665 mg/L to 690 mg/L. This is from poor quality water recharging the groundwater reservoir, probably deep percolation from irrigation. The area of deterioration probably extends to the west.

Groundwater withdrawals during the 1964-81 period averaged about 27,500 acre-feet, nearly three times the 1951-63 period average of 9,600 acre-feet. Most of the increase was from deep wells for irrigation with some use for municipal purposes. This increased use has caused a decline in the water levels of 10 to 13 feet in the shallow aquifer over several square miles in an area about four miles west of Delta. Water levels have declined up to 19 feet in the deep aquifer in an area about two miles south of Delta. There has been some decrease in the number of flowing wells. Groundwater withdrawals from wells during 1963-95 are shown in Figure 19-5.

19.2.11 Pahvant Valley Groundwater Basin[36,43,58]

The Pahvant Valley groundwater reservoir is fed by the mountain streams from the Pahvant Plateau along the east side of the valley. There is also groundwater inflow from the mountain bedrock. Most of the groundwater outflow is through the basalt flows on the west side of the valley into Clear Lake Spring. There is also groundwater movement from Pahvant Valley north toward the Sevier Desert area south of Delta.

The Pahvant Valley aquifer is made up of sands and gravels deposited during the Recent and Pleistocene ages. The aquifer materials are coarser near the mountains and become finer to the west. The beds of coarser material are interlayered with clay materials and as water moves from the mountains to the west, these confining layers create artesian conditions. The coarser beds are connected laterally and the confining beds are not perfect aquicludes so there is both horizontal and vertical movement of water. Most of the recharge percolates down as water crosses the alluvial fans in streams, irrigation ditches and from irrigated fields.

The basaltic Pahvant Flow in the western part of the valley and the basalt underlying the area west of Black Rock Volcano are both unconfined aquifers interlayered with unconsolidated deposits. The groundwater is supplied mainly by upward leakage from the artesian aquifer, percolation of irrigation water and precipitation.

Table 19-5
GROUNDWATER RECHARGE/DISCHARGE-SOUTHERN JUAB VALLEY

Source	Annual Recharge (acre-feet)
Seepage from nonirrigation-season stream flow	2,400
Seepage from canals and unconsumed irrigation water	4,300
Infiltration of precipitation	2,600
Subsurface inflow and seepage from ephemeral streams - east side	1,200
Subsurface inflow and seepage from ephemeral streams - west side	1,500
Total recharge	12,000

Source	Annual Discharge
Wells	
Pumped - Irrigation and public use	5,300
- Domestic and stock use	100
Flowing	900
Total wells	6,300
Springs and seeps	
Palmer Spring	700
Seepage to Chicken Creek reservoir	1,100
Total springs and seeps	1,800
Evaportanspiration	3,900
Subsurface	-0-
Total discharge	**12,000**

Table 19-6
GROUNDWATER RECHARGE/DISCHARGE-SEVIER DESERT BASIN

Source	Annual Recharge (acre-feet)
Stream seepage	27,000
Canal seepage	12,700
Reservoir seepage (Fool Creek Reservoir)	2,800
Irrigation water (deep percolation)	9,000
Precipitation	7,000
Groundwater tributary Inflow	18,000
Total	76500

Source	Annual Discharge
Seepage to Sevier River	6,500
Evapotranspiration	20,000
Groundwater outflow	31,000
Well withdrawals	31,000
Total	88,500

Estimates indicate the volume of groundwater in storage in Pahvant Valley is about 11 million acre-feet in the upper 200-500 feet of alluvium. Of this amount, less than one million acre-feet is recoverable. Prevention of long-term mining and protection of junior water rights are factors regulating recovery of groundwater. The cost of electricity is also a factor restricting pumping.

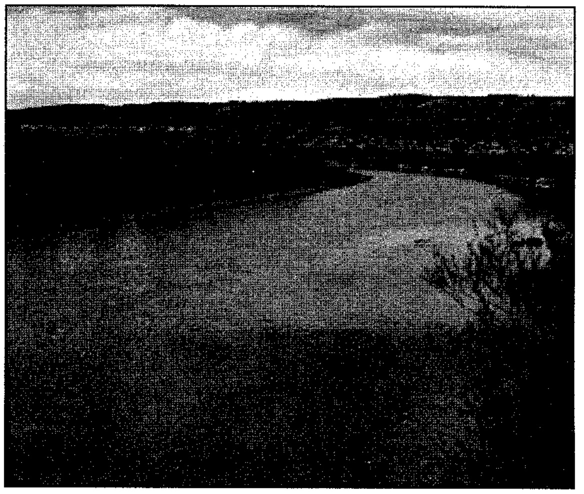
There appears to be a groundwater restriction along the western border of Pahvant Valley consisting of fine-grained silts and clays. It is unclear how groundwater moves from Pahvant Valley into Clear Lake Springs but a fault and fracture system could act as a conduit. However, flood flows leaked out of the valley relatively fast during the 1980s. Flood water from Chalk Creek flowed into “The Sink” about three miles northwest of Flowell. Flood flows from Corn Creek reached a low area about 7 miles west of Kanosh and seeped into the ground through a series of sink holes. Normally flows do not reach these areas.

Pahvant Valley is divided geologically and hydrologically into six districts. These districts are McCornick, Greenwood, Pahvant, Flowell, Meadow and Kanosh. They have all been developed to provide irrigation water. Data for these districts is shown in Table 19-7.

Recharge - Total recharge varies from year to year depending on climatic factors. During years of low precipitation, recharge is less than during wet years such as 1983-84. Total recharge was over 70,000 acre-feet in 1959. Recharge from various sources is shown in Table 19-8.

Discharge - Discharge from the groundwater reservoir is from springs, evapotranspiration, wells and groundwater outflow. Discharge is shown in Table 19-8.

The withdrawal from wells has steadily increased since the first wells were drilled near Flowell in 1915. Discharge was primarily from flowing wells until the availability of electricity in 1952. As discharge from pumped wells decreased until by 1983, it was less than 1,000 acre-feet. Flowing well discharge increased again due to increased precipitation in 1982-84 to 9,500 acre-feet in 1984, 23,000 acre-feet in 1985, and 22,000 acre-feet in 1986. During the drought of 1977, well withdrawls were 96,000 acre-feet. Since that time, total withdrawals have been less. Most of the wells are between 200 and 500 feet deep in basin fill and 100 feet to 200 feet deep in basalt aquifers.



River flow comes from groundwater

There have been water-level declines over 50 feet in some areas of Pahvant Valley from 1953 to 1980. The water levels have mostly recovered as a result of the unusually wet years from 1983-85. Withdrawals from groundwater are shown on Figure 19-6.

Water Oualitv - There is a wide range in water quality in Pahvant Valley. A well about 4 miles northwest of Holden tested 300 mg/L total dissolved-solids (TDS) while some hot springs 4 miles northwest of Kanosh contained 9,000 mg/L TDS. The eastern part of Pahvant Valley has groundwater concentrations less than 1,000 mg/L TDS while most of the remaining area has concentrations ranging from 1,000 to 5,000 mg/L TDS. The farming area west of Kanosh has the poorest quality water with TDS concentrations over 5,000 mg/L. This has been attributed to recirculation of irrigation water which may account for up to 50 percent of the pumped well water. These larger concentrations are generally sodium chloride or sodium chloride sulfate types. The quality of water as it pertains to irrigation is shown in Table 19-9.

Figure 19-5

Sevier Desert

ESTIMATED WITHDRAWAL FROM WELLS

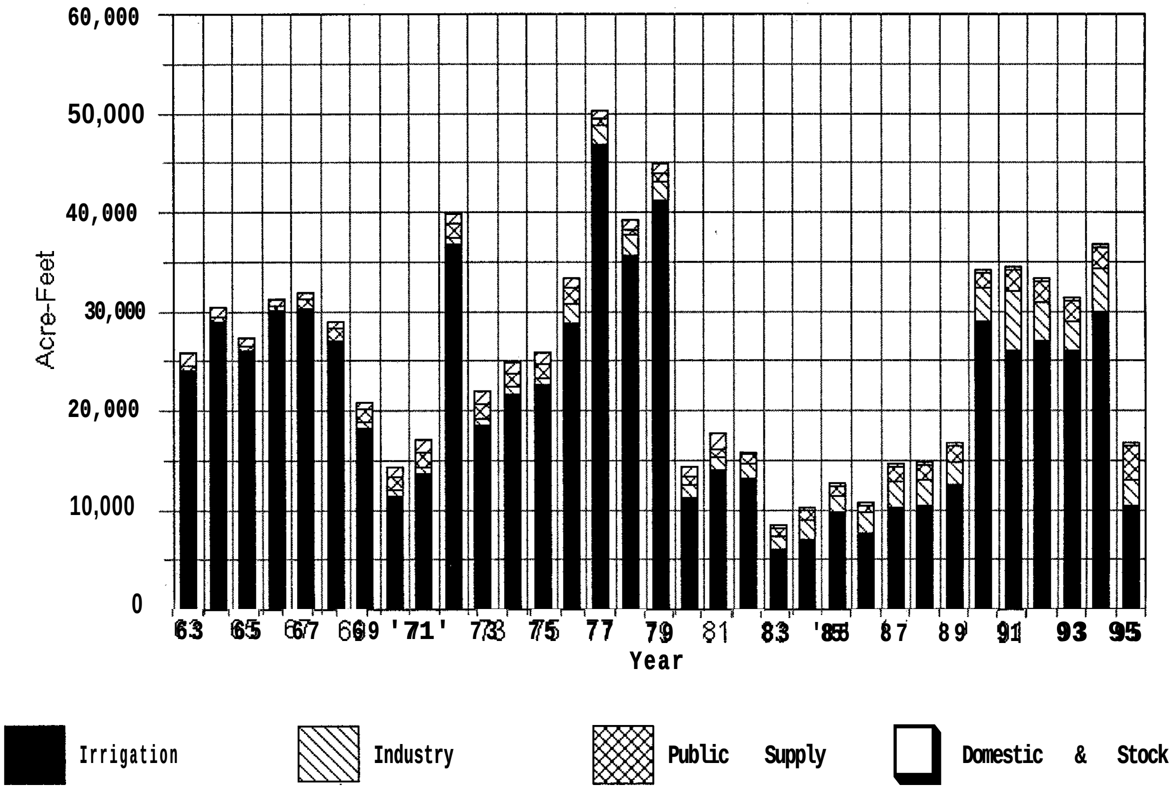


Table 19-7
PAHVANT VALLEY GROUNDWATER RESERVOIR

District	Average Thickness (feet)	Area (acres)	Storage (1,000 ac-ft)	Withdrawals (acre-feet)	Water Quality
McCornick	27.5	17,500	1,200	NA	Good
Greenwood	300	31,000	2,300	NA	Good
Pahvant	200	9,500	480	NA	Good
Flowell					
Alluvium	500	34,500	4,300	NA	Fair-poor
Basalt	50	6,500	20	NA	Fair
Meadow	350	24,500	2,200	NA	Good-fair
Kanosh	300	14,000	500	NA	Good-poor
Total		137,500	11,000	84,000	

Source: Ground-Water Resources of Pahvant Valley, Utah, 1965.[43]

Table 19-8
GROUNDWATBR RECHARGE/DISCHARGE-PAHVANT VALLEY

Source	Annual Discharge (acre-feet)
Seepage from streams	20,500
Central Utah Canal seepage	3,300
Irrigation water deep percolation	39,000
Precipitation infiltration	11,000
Total	73300
Source	**Annual Discharge**
Springs	3,500
Evapotranspiration	29,000
Wells	78,000
Total	110,500

19.3 GROUNDWATER PROBLEMS AND NEEDS

The groundwater reservoirs appear to be in stable condition with a few exceptions. This is due to the limited development allowed in most areas of the Sevier River Basin. Two exceptions are the Sevier Desert and Pahvant Valley.

In the Sevier Desert, the shallow artesian aquifer has declined up to six feet west and north of Delta and as much as nine feet between Oak City and Fool Creek Reservoirs from 1991 to 1996. During the same period, the deep artesian aquifer declined up to seven feet in a band from Oak City through the Leamington-Lynndyl area and around to the north and west of Delta to an area west and southwest of Deseret. Previously from 1963-81, the shallow artesian aquifer declined up to 10 feet west and north of Delta and over live feet between Oak City and Fool Creek Reservoirs. During this period, the deep artesian aquifer declined up to 19 feet around Delta, 11 feet south of Oasis and six feet north and west of Delta. It also declined up to eight feet in the Oak City and Learnington-Lynndyl area.

Water levels in Pahvant Valley have declined up to 14 feet around McCornick, west of Holden and about six miles southwest of Kanosh between 1991 and 1996. Levels have declined up to seven feet over the rest of the valley. Water levels in the recharge areas below the alluvial fans of Chalk and Meadow creeks have risen up to seven feet with increases up to 15 feet below the Corn Creek fan during this same period.

Water quality in the Hatton area west of Kanosh is becoming a problem. In the Kanosh farming district, the dissolved-solids concentrations have increased from 2,000 mg/L to 6,000 mg/L in some wells since the 1950s.

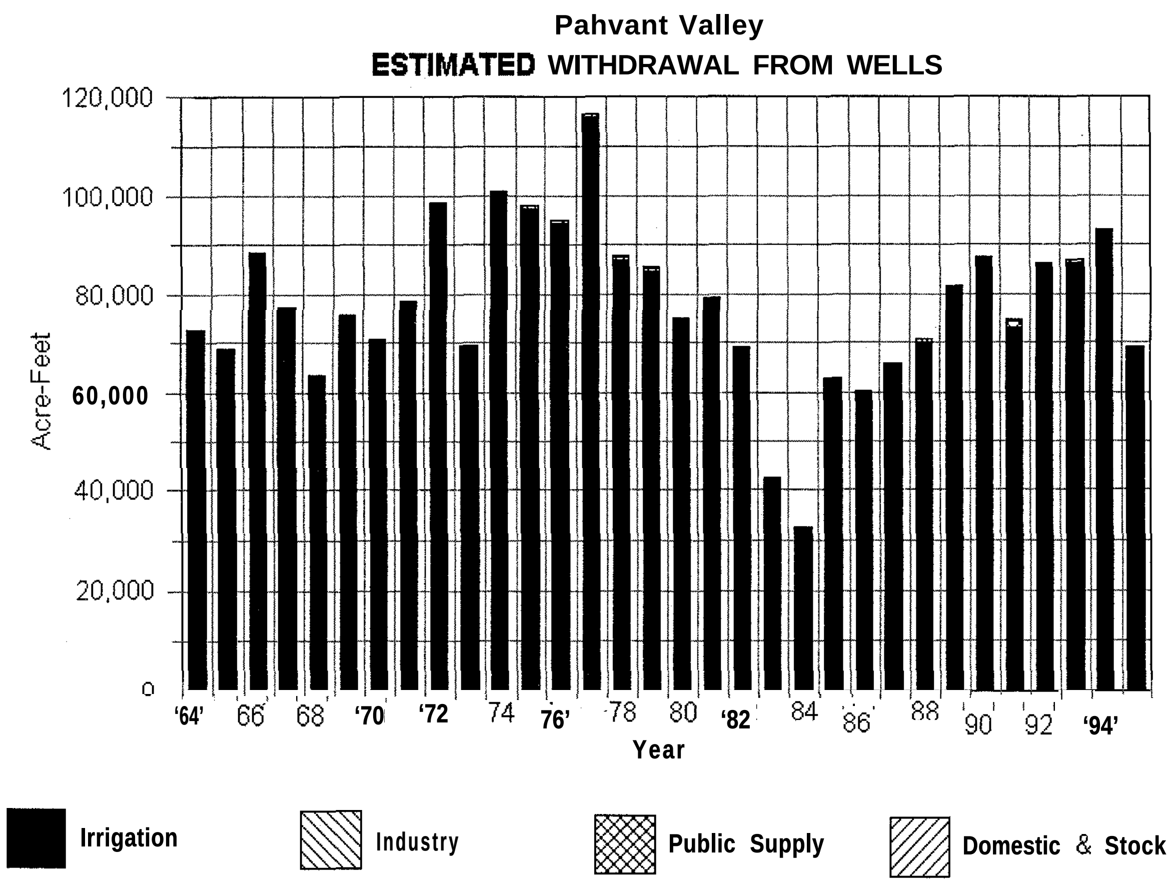
19.4 GROUNDWATER MANAGEMENT PLANS

The State Engineer is working on new groundwater management plans throughout the entire basin. Work has progressed considerably in Pahvant Valley over the last few years with restrictions on unauthorized groundwater withdrawals. In March 1997, the State Engineer closed all of the Sevier River system to additional well permits. This was ordered to stop the increased drilling of domestic wells with flows of 0.015 cfs or two acre-feet until a management strategy could be prepared. The only exception would be transferring an existing water right to a domestic well permit.

19.5 GROUNDWATER MANAGEMENT ALTERNATIVES

There are over five million acre-feet of groundwater stored in the top 200 feet of alluvium in underground reservoirs throughout the Sevier River system above Sevier Bridge Reservoir. Studies by the U.S. Geological Survey during the 1980s have indicated limited development of groundwater in some areas could take place. There would be downstream as well as within basin effects although they would vary from basin to basin. The decrease in downstream flows would be from 15 to 20 percent of the increased groundwater withdrawal. Other impacts may occur in the yields of springs and use by phreatophytes. See Section 9.5.2, Groundwater Management for more discussion.

Figure 19-6



Pahvant Valley
ESTIMATED WITHDRAWAL FROM WELLS
120,000
100,000
80,000
60,000
40,000
20,000
0
Acre-Feet
'64'
66
68
'70
'72
74
76'
78
80
'82
84
86
88
90
92
'94'
Year
Irrigation
Industry
Public Supply
Domestic & Stock

Table 19-9
QUALITY OF GROUNDWATER FOR IRRIGATION-PAHVANT VALLEY

District	Salinity Hazard	Sodium Hazard
McCornick	High	Low
Greenwood	High	Low
Pahvant	High	Low, east; High, west
Flowell[a]	Medium to High	Low
Meadow	Medium to High	Low
Kanosh	Very High	Medium to High

[a] Groundwater in the basalt aquifer has three times the concentrations as groundwater to the east.